Monthly observations of the magnetical and meteorological instruments for August; also two absolute determinations of the horizontal intensity, taken in January and April 1841.

Monthly and term-day observations for May, June and July 1841.

Magnetic dip and intensity taken at Johanna, Madras and Singapore.

3. The Magnetic Observatory at Simla.

Magnetic and meteorological observations for January, February, March and April 1841; also transcripts of sheets D. for January, February and March 1841, to be substituted for similar sheets for those months.

Preliminary observations regarding the Magnetic Observatory at Simla for May 1841.

Observations for June 1841, including term-day curves; also a general abstract of the mean readings of the instruments.

Magnetic term observations for July and August 1841, made at the Magnetic Observatory, Simla.

4. "Variations de la déclinaison et intensité horizontale magnétique observées à Milan, pendant 24 heures de suite, le 28 et 27 Novembre 1841." Par Signor Carlini, For. Memb. R.S.

5. "On a Calculating Machine." By the Rev. Henry Moseley, M.A., F.R.S., Professor of Natural Philosophy and Astronomy in King's College.

The object which the author proposes to accomplish in the construction of this machine, is to determine mechanically the products, quotients, logarithms, squares, and other powers of the natural numbers, by means of combinations of greater simplicity than have hitherto been applied to the purposes of mechanical calculation. The paper is accompanied by a figure illustrating the principle of the machine, but not representing the mechanical details of its construction. An outline is then given of the essential parts of the instrument, and of the theory of their operation.

6. A paper was also in part read entitled, "On Fibre." By Martin Barry, M.D., F.R.SS. Lond. and Edin.

January 6, 1842.

LIEUT.-COLONEL WM. HENRY SYKES, V.P., in the Chair.

Lieut. Thomas John Newbold was balloted for, and duly elected a Fellow of the Society.

The reading of a paper entitled, "On Fibre," by Martin Barry, M.D., F.R.SS. Lond. and Edin., was resumed and concluded.

The author observes, that, in the mature blood-corpuscle, there is

often seen a flat filament, already formed within the corpuscle. In Mammalia, including Man, this filament is frequently annular; sometimes the ring is divided at a certain part, and sometimes one extremity overlaps the other. This is still more the case in Birds, Amphibia, and Fishes, in which the filament is of such length as to constitute a coil. This filament is formed of the discs contained within the blood-corpuscle. In Mammals, the discs entering into its formation are so few as to form a single ring; and hence the biconcave form of the corpuscle in this class, and the frequent annular form of the filament it produces. In the other Vertebrata, the discs contained within the blood-corpuscle are too numerous for a single ring; and they consequently form a coil. At the outer part of this coil, the filament, already stated to be flat, often presents its edge; whence there arises a greater thickness of the corpuscle, and an appearance of being cut off abruptly at this part; while in the centre there is generally found the unappropriated portion of a nucleus; and hence the central eminence, surrounded by a depression, in those corpuscles which, from the above-mentioned cause, have the edge thickened. The nucleus of the blood-corpuscle in some instances resembles a ball of twine; being actually composed, at its outer part, of a coiled filament. In such of the invertebrata as the author has examined, the blood-corpuscle is likewise seen passing into a coil.

The filament, thus formed within the blood-corpuscle, has a remarkable structure; for it is not only flat, but deeply grooved on both surfaces, and consequently thinner in the middle than at the edges, which are rounded; so that the filament, when seen edgewise, appears at first sight to consist of segments. The line separating the apparent segments from one another is, however, not directly transverse, but oblique.

Portions of the clot in blood sometimes consist of filaments having a structure identical with that of the filament formed within the blood-corpuscle. The ring formed in the blood-corpuscle of Man, and the coil formed in that of Birds and Reptiles, have been seen by the author unwinding themselves into the straight and often parallel filaments of the clot; changes which may be also seen occurring in blood placed under the microscope before its coagulation; and similar coils may be perceived scattered over the field of view, the coils here also appearing to be altered blood-corpuscles, in the act of unwinding themselves; filaments, having the same structure as the foregoing, are to be met with apparently in every tissue of the body. The author enumerates a great variety of organs in which he has observed the same kind of filaments.

Among vegetable structures, he subjected to microscopic examination the root, stem, leaf-stalk, and leaf, besides the several parts of the flower: and in no instance of phanerogamous plants, where a fibrous tissue exists, did he fail to find filaments of the same kind. On subsequently examining portions indiscriminately taken from ferns, mosses, fungi, lichens, and several of the marine algæ, he met with an equally general distribution of the same kind of filaments. The flat filament seen by the author in all these structures, of both ani-

mals and plants, he states to be that usually denominated a *fibre*. Its appearance is precisely such as that of the filament formed within the corpuscle of the blood. It is known, he remarks, that discoid corpuscles circulate in plants; and it remains to be seen whether or not filaments are formed also in these.

By gradually tracing the fibre or filament above-mentioned into similar objects of larger size, the author endeavours to show that it is not possible to draw a line of separation between the minutest filament, and an object being to all appearance composed of two spirals running in opposite directions, and interlacing at certain regular intervals; an arrangement which produces in the entire object a flattened form, and gives it a grooved appearance. It is, in fact, the structure which, for want of a better term, he has called a *flat filament*. The edge of this filament presents what, at first sight, seem like segments, but which, in reality, are the consecutive curves of a spiral thread. A transverse section of such an object is rudely represented by the figure 8. This is also precisely the appearance presented by the minutest filament, generally termed *Fibre*: and the author particularly refers to the oblique direction of the line separating the apparent segments in the smaller filament, in connexion with the oblique direction of the spaces between the curves of the spiral threads in the larger one.

The spiral form, which has heretofore seemed wanting, or nearly so, in animal tissues, is then shown to be as general in animals as in plants. Nervous tissue, muscle, minute blood-vessels, and the crystalline lens, afford instances in proof of this. And if the author's view of identity in structure between the larger and the smaller filaments be correct, it follows that spirals are much more general in plants themselves than has been hitherto supposed; spirals would thus appear, in fact, to be as universal as a fibrous structure.

The tendency to the spiral form manifests itself very early. Of this the most important instance is afforded by the corpuscle of the blood, as above described. The author has also obtained an interesting proof of it in cartilage from the ear of a rabbit; where the nucleus, lying loose in its cell, resembled a ball of twine, being composed at its outer part of a coiled filament, which it was giving off to weave the cell-wall;—this cell-wall being no other than the last-formed portion of what is termed the intercellular substance—the essential part of cartilage. These nuclei in cartilage, as well as those in other tissues, there is ground for believing to be descended, by fissiparous generation, from the nuclei of blood-corpuscles.

The author then describes the mode of origin of the flat filament or fibre, and its reproduction in various animal and vegetable tissues, which he enumerates. He conceives that each filament is a compound body which enlarges, and, from analogy, may contain the elements of future structures, formed by division and subdivision, to which no limits can be assigned.

He then traces the formation of muscle out of cells, which, according to his observations, are derived from corpuscles of the blood, to the state where there exists what is denominated the *fibril*. In

this process, there are to be observed the formation of a second order of tubes within the original tube; a peculiarly regular arrangement of discs within these second tubes; the formation, first of rings and then of spirals, out of discs so arranged; the interlacing of the spirals; and the origin, in the space circumscribed by these, of spirals having a minuter size; which in their turn surround others still more minute; and so on. The outer spirals enter for the most part into the formation of the investing membrane discovered by Schwann, but for the only complete description of which, in a formed state, we are indebted to Mr. Bowman. The inner spirals constitute what are denominated the *fibrillæ*. The fibril appears to the author to be no other than a state of the object which he designates a *flat filament*; and which, as he shows, is a compound structure. The fibril he finds to be, not round and beaded, as it has been supposed, but a flat and grooved filament; the description above given of the structure of the filament being especially applicable here. This flat filament is so situated in the fasciculus of voluntary muscle, as to present its edge to the observer. It seems to have been the appearance presented by the edge of this filament, that is to say, by the curves of a spiral thread, that suggested the idea of longitudinal bead-like enlargements of the fibril, as producing striæ in the fasciculus of voluntary muscle. In the author's opinion, the dark longitudinal striæ are spaces (probably occupied by a lubricating fluid) between the edges of flat filaments, each filament being composed of two spiral threads, and the dark transverse striæ, rows of spaces between the curves of these spiral threads. The filament now mentioned, or its edge, seems to correspond to the *primitive marked thread* or *cylinder* of Fontana—to the *primitive fibre* of Valentin and Schwann—to the *marked filament* of Skey—to the *elementary fibre* of Mandl—to the *beaded fibril* of Schwann, Müller, Lauth, and Bowman—and to the *granular fibre* of Gerber. The changes known to be produced by the alternate shortening and lengthening of a single spiral are exhibited in the microscope by a fasciculus of spirals, not only in its length and thickness, but in the width of the spaces (*striæ*) between the curves of the spirals. And a muscle being no other than a vast bundle of spirals, it is in contraction short and thick; while in relaxation it is long and thin; and thus there occurs no flattening of bead-like segments in contraction. The author has found no segments that could undergo this change. These observations on the form of the ultimate threads in voluntary muscle, were first made on the larva of a Batrachian reptile; and have been confirmed by an examination of this structure in each class of vertebrated animals, as well as in the Crustacea, Mollusca, Annelida, and Insects.

He finds that the toothed fibre, discovered by Sir David Brewster in the crystalline lens, is formed out of an enlarged filament; the projecting portions of the spiral threads in the filament, that is, the apparent segments, becoming the teeth of that fibre.

The compound filaments are seen with peculiar distinctness in the blood-vessels of the arachnoid membrane. In connexion with the spiral direction of the outer filament in these vessels, the author refers

to the rouleaux in which the red blood-discs are seen to arrange themselves, in the microscope, as probably indicating a tendency to produce spiral filaments. To form rouleaux, corpuscle joins itself to corpuscle, that is to say, ring to ring; and rings pass into coils. The union of such coils, end to end, would form a spiral. But the formation by the blood-corpuscles of these rouleaux is interesting in connexion with some facts recorded by the author in a former memoir; namely, that many structures, including blood-vessels, have their origin in rows of cells derived from corpuscles of the blood. The human spermatozoon presented a disc with a pellucid depression, each of the two sides of the peripheral portion of which was extended into a thread; these two threads forming by being twisted the part usually designated as the tail. The occurrence of two tails, observed by Wagner, is accounted for by the author by the untwisting of these threads.

The author has noticed very curious resemblances in mould, arising from the decay of organic matter, to early stages in the formation of the most elaborate animal tissues, more particularly nerve and muscle. Flax has afforded satisfactory evidence of identity, not only in structure, but in the mode of reproduction, between animal and vegetable fibre.

Valentin had previously stated that in plants all secondary deposits take place in spiral lines. In the internal structure of animals, spirals have herotofore seemed to be wanting, or very nearly so. Should the facts recorded in this memoir, however, be established by the researches of other investigators, the author thinks the question in future may perhaps be, where is the "secondary deposit" in animal structure, which is not connected with the spiral form? The spiral in animals, as he conceives he has shown, is in strictness not a secondary formation, but the most primary of all; and the question now is, whether it is not precisely so in plants.

In a postscript the author observes, that there are states of voluntary muscle in which the longitudinal filaments ("fibrillæ") have no concern in the production of the transverse striæ; these striæ being occasioned by the windings of spirals, within which very minute bundles of longitudinal filaments are contained and have their origin. The spirals are interlaced. When mature, they are flat and grooved filaments, having the compound structure above described. With the shortening of the longitudinal filaments ("fibrillæ") in muscular contraction, the surrounding spirals, and of course the striæ, become elongated and narrow; while in relaxation these changes are reversed.

January 13, 1842.

SIR JOHN WILLIAM LUBBOCK, Bart., V.P. and Treas., in the Chair.

Edward Hodges Baily, Esq., R.A., William Fishburn Donkin,

Esq., M.A., and Charles James Buchanan Riddell, Esq., Lieut. in the Royal Artillery, were balloted for, and severally elected Fellows of the Society.

A paper was in part read, entitled, "Researches in Physical Geology:" Third Series. By William Hopkins, Esq., M.A., F.R.S.

January 20, 1842.

SIR JOHN WILLIAM LUBBOCK, Bart., V.P. and Treas., in the Chair.

His Majesty the King of Prussia was balloted for, and duly elected a Fellow of the Society.

John Tricker Conquest, M.D., and Francis Henry Ramsbotham, M.D., were severally balloted for, but not elected into the Society.

1. The reading of a paper, entitled, "Researches in Physical Geology:" Third Series. By William Hopkins, Esq., M.A., F.R.S., was resumed and concluded.

In a paper formerly read to the Society, the author had investigated an analytical expression for the precession of the pole of the earth, on the hypothesis of the earth's being composed of a heterogeneous solid shell inclosing a heterogeneous fluid; and showed that its amount, deduced from that hypothesis, could not agree with its actual observed amount, unless the ellipticity of the interior surface of the shell were less by a certain quantity than that of the exterior surface. As the ellipticity of the inner surface (assuming always that the earth was originally fluid) depends on the thickness of the shell, the author, in the present paper, determines the least thickness which can be deemed compatible with the observed amount of precession.

In his former communication, the author had contemplated only the case in which the transition from the solidity of the shell to the fluidity of the mass contained in it was immediate; but in the case of the earth it must be gradual and continuous. It is remarked, however, that if in the actual case we were to consider all that portion of the mass as solid which is not perfectly fluid, we should take the thickness of the shell too great; and, on the other hand, if we were to consider the whole of that as perfectly fluid which is not perfectly solid, we should take the thickness of the shell too small. There must, consequently, be some surface of equal fluidity, (or, if we please, of equal solidity,) such that if all above it were perfectly solid, and all beneath it perfectly fluid, the precession would be the same as in the case in which the transition from the solidity of the shell to the fluidity of the interior mass is continuous. This surface is termed by the author the *effective inner surface*; and the distance